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[FIFTH SERIES.]

"…………………… per litora spargite muscum,
Naiades, et circùm vitreos considite fontes;
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

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I.—*On* Aphis rumicis, *Linn., as a Pest on the Mangel-Wurzel Crops in Shropshire in the Autumn of* 1885, *and on a Fungus destructive of the same* Aphis. By Rev. WILLIAM HOUGHTON, M.A., F.L.S., and WILLIAM PHILLIPS, F.L.S.

[Plate III.]

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,—I have to record the occurrence of a species of *Aphis*, which I take to be the *A. rumicis* of Linné, the *A. fabæ* of Curtis, infesting the leaves of the mangel plants in this neighbourhood, last September and October, to a considerable and very threatening degree. I never noticed any species of *Aphis* to any extent on mangel crops before last autumn. As a rule, this plant has, in our own country at least, comparatively few insect enemies. No record of mangels suffering much from any insect attack appears till the year 1844, when, in the north of Ireland, entire crops were destroyed by the larvæ of one of the carrion-beetles, *Silpha opaca*, which infested the young plants in spring, feeding on the leaves and leaving only the fibres; the roots were not attacked. In 1846 and 1847 they again injured the crops, and, indeed, to this day it appears that they continue to be an

Irish pest. A few other mangel enemies are known to have caused much damage in France, but not in this country, with the notable exception of the two-winged fly (*Anthomyia betæ*), which first, I think, in the autumn of 1862 attacked the crops in Shropshire and the Midland counties generally, causing very serious injury*. Since that date this *Anthomyia* has, from time to time, caused considerable damage in different English counties, sometimes appearing on the dicotyledonous leaves in the early summer as well as on the full-grown leaves in the autumn; and now, for the first time in Shropshire, another insect foe, whose known antecedents imply the possibility of very serious mischief to the mangels, appears. The *Aphis rumicis*, Linn., popularly known as "black dolphin" in some districts, "collier" or "black smother-fly," is, I feel pretty sure, the species in question. The diagnosis of the Aphides in closely allied species is very difficult, and the absolute differentiation of *A. rumicis* and *A. atriplicis*, for instance, is especially so. However, I carefully compared a great number of these mangel Aphides with specimens on the beans in my own garden, and could see no difference between the two lots.

Mr. Buckton, the author of the valuable 'Monograph of British Aphides,' Ray Society, to whom I sent fresh specimens of the *Aphis* on some affected leaves, corroborated my identification. Miss Ormerod informs me that *A. papaveris* is mentioned by Kaltenbach as occurring on almost all kinds of plants, and especially on mangel; but I feel sure that *A. papaveris* is not the species I examined. The same lady also informs me that in the course of the year before last she received numerous specimens on mangels, which appeared to her to belong to *A. atriplicis*, Linn. It is not improbable therefore that the three species—*A. rumicis*, as noticed by myself, *A. papaveris*, as mentioned by Kaltenbach, and *A. atriplicis*, as examined by Miss Ormerod—are all occasional mangel pests.

Buckton says that *A. rumicis* is almost omnivorous; though its common food-plants are *Rumex crispus*, *Carduus lanceolatus*, and the stalks and top shoots of the broad-bean; it is also found on the flower-heads of the garden rhubarb and ivy-shoots, on *Polygonum persicaria*, *Borago officinalis*, *Digitalis purpurea*, and other plants. Mr. Buckton also informs us that in 1854 the ravages of this *Aphis* in the turnip-fields of Yorkshire were very marked, many hundred acres being utterly ruined. Now, one of the fields visited by me last autumn contained a crop of mangels and a crop of swedes; the former plants were covered with the conspicuous black *Aphis*-population, but the swedes were not attacked at all; even the row adjacent to the infected mangels was free from them. *Aphis brassicæ* occurred, but not *A. rumicis.* This fact would lead one to believe that the *Aphis* prefers mangels to swedes, and that probably it has a predilection for plants either of the same species or belonging to the same natural order. In the absence of an abundant supply of their favourite food the insects take to other food-plants readily accessible. The question of its almost omnivorous habits may be to some extent determined by the absence of its favourite food from certain localities.

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* See my paper in the 'Quarterly Journal of Microscopic Science' for 1863, where the female fly is figured and described for the first time.

The affected leaves presented on their under surfaces large black masses of *Aphis*-life, almost every leaf of the plant was sometimes covered, the result being that the whole showed a sickly yellow hue, the underside of the leaves being deeply puckered and distorted; after a time the leaves drooped and withered. For some time the damage continued, the apterous viviparous females being excessively prolific and producing their young larvæ in prodigious numbers. I have counted as many as thirty larvæ in various stages of development in a single individual. One might occasionally see amongst these black *Aphis* masses some dried-up skins of the insect, the result of ichneumon-parasitism; but, on the whole, no marked beneficial result from insect-agency was apparent, and one began to fear for the mangel crops. Fortunately, however, an effective aid suddenly came to the rescue in the presence of a microscopic fungus of some kind which completely covered the Aphides. About the beginning of October I noticed that these black *Aphis*-patches on the leaves contained a number of red or rust-coloured spots, which proved to be Aphides either in a moribund or dead state. The microscope revealed the presence of some fungus, which it was quite clear was plying its beneficial destructive agency most vigorously on the *Aphis*-groups.

I placed some infected aphides under a glass with healthy specimens from my garden-beans, and in a short time these became similarly covered with the same red-coloured fungoid growth. The niggers took the scarlet fever and died. On submitting this fungoid growth to the microscope, I could detect numerous conidia amongst the filaments, but could not quite satisfy myself as to their origin and mode of attachment. About the end of October another phenomenon presented itself: the red aphides turned a dull green both on the plants in the fields and on the leaves I had under observation in my study. The aphides had already succumbed to the red fungus; what was the green growth which supervened? Was it the same fungus under a different aspect and in a more complete stage of development, or was it another fungus altogether? Were these two growths—the preliminary rusty-red one and the subsequent green one—genetically related to each other, or were they distinct plants? With a view to determine this question I sent specimens to my friend Mr. William Phillips, of Shrewsbury, a gentleman who has paid great attention to mycological subjects, and who is one of our most painstaking and cautious observers.

The occurrence of fungoid growth on aphides is mentioned by Buckton (Brit. Aphides, ii. p. 18, iv. p. 184), and has been noticed by several investigators. The first-named writer says that on the leaves of peach-trees in summer "there are often to be found isolated specimens of *Rhopalosiphon dianthi* whose bodies have been entirely destroyed by what would appear to be a species of *Penicillium*. The outer surface of the body to the eye appears like the pile of reddish velvet, which, under a high magnifying-power, resolves itself into a mass of jointed threads. On cutting into the body of such an aphis, the adipose matter, usually so abundant, appears to have undergone a saccharine degradation."

This fungus may prove to belong to the genus *Entomophthora*, and to be identical with that of which Mr. Phillips gives an account in the following letter:—

"*Fungus on Aphides.*

"Two conditions of the dead bodies of the aphides on mangel-leaves you kindly sent me were noticeable—the one a rusty red, the other a dull green colour—both produced by the growth of one or more, probably two, species of fungi. It was not possible to say at first sight whether the red preceded or followed the green growth, or whether the two were genetically related. On placing a few bodies covered by the red growth under a bell-glass in a damp atmosphere they became covered in about two days by the green growth, whereas the green so treated did not change to red. It is very difficult to determine the question of relationship between fungi thus associated, and all I was able to do in the time at my command was to examine the morphology of these fungi with a view of ascertaining their relationship to allied species already described. The result may be given in a few words.

"Those insects which were killed by the red fungus had died in a standing position with the legs extended (Pl. III. A, fig. 1) or, more rarely, folded beneath the body. The bodies of some were only partially discoloured by the little patches of the fungus, while others were completely covered, except the legs, so as to conceal all markings of the body. In this last condition they are considerably enlarged, but retain their general outline, and are firm and tough under the knife. When viewed with a 1-inch object-glass the fungus is seen as a closely-packed layer of glistening reddish-brown particles, which, when recourse is had to the higher power of a quarter of an inch, are resolved into elliptic or obovate cells supported on subcylindrical elongated cells issuing from the inside of the insect's body (figs. 8–12). Dividing one of the bodies by a longitudinal cut, the viscera are seen to be absorbed and replaced by a compact mass of fungus-threads of the same colour as those on the surface. Examining this mass under a quarter-inch object-glass, it is seen to be made up of more or less elongated tubular cells (figs. 2–7), varying in diameter from ·005 to ·015 millim., and in length from ·05 to ·15 millim.; they are irregularly bent, sometimes branched (fig. 5), and occasionally septate (fig. 7); the interior of the cells is filled with coarsely granular protoplasm, with numerous large vacuoles. The ends of these cells force themselves through the body of the insect to the outside, and bear conidia on their summits, which are formed by abstriction (figs. 8–12). If these conidia are detached from the conidiophore before they are mature, as happens under the pressure of the covering-glass, the base is truncate (fig. 13, *a*, *a*, *a*), but if allowed to mature they are elliptic or obovate (fig. 13, *b*, *b*); they are occasionally in a later stage observed throwing out germ-tubes at either end (fig. 13, *c*, *c*).

"From the above brief description it will be at once apparent that this rusty-red fungus causing the destruction of the aphides is a close ally of the well-known *Empusa muscæ*, Cohn, which attacks and kills the common house-fly. Fresenius has created the genus *Entomophthora* * for the reception of these insect-killing species, in which Dr. Winter, in his new edition of Rabenhorst's 'Kryptogamen Flora,' includes ten species. One of these, *E. aphidis*, Hoffm.†, is found on an aphis on *Cornus sanguinea*; but this is essentially different from the one found on mangel, as I have been able to satisfy myself by the examination of an authentic specimen kindly lent me by Dr. Cooke. I was not fortunate enough to find the resting-spore in the mangel aphis; but should it appear again this autumn I may be more successful. The species may be called pro tem. *Entomophthora ferruginea*, n. s.

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* Bot. Zeitung, 1856, p. 883.

† Fresenius, "Ueber die Pilzgattung *Entomophthora*," in Abhandl. der Senckenb. natur. Gesellsch. Band ii. p. 208, t. ix. figs. 59–67.

"The dull green fungus which at a later stage covers the dead bodies of the aphides and entirely obscures, though it does not destroy, the above-described *Entomophthora*, bears a general resemblance to *Penicillium glaucum* to the naked eye (Pl. III. B, fig. 1). This also sends its more delicate mycelial threads through the mummified aphides, appearing at length on the outer surface as erect dendritic conidiophores (fig. 2). It can be best traced in the legs of the insect, which are usually unaffected by the *Entomophthora*. After traversing the interior of the leg it issues from between the joints (fig. 3), throwing up a number of slender septate threads, about ·5 millim. high and ·004 millim. broad, which form a fasciculate head of dichotomously branching chains of conidia, which are cylindrical, rounded at the ends, and variable in length. This appears to agree with *Penicillium cladosporioides*, Fresen. Beitr. t. iii. figs. 23–28."

Since the above was in type, Mr. Phillips informs me that he has not seen *Entomophthora Planchoniana*, described by Prof. Max Cornu, of Paris, which also grows on aphides, and should be compared with the above (*vide* 'Bulletin de la Société Bot. de France,' 1873, p. 189). I observe also that Miss Ormerod records, as an insect injurious to mangels, the beetle *Steropus madidus* (Royal Agricult. Soc. Report, April 1886, p. 311), "previously believed to be only carnivorous." As this insect is one of the Harpalidæ, some species of which are known to be herbivorous (see Westwood's 'Mod. Class. of Insects," i. p. 63), it is quite probable that we may hear more of this little beetle as an enemy to mangel crops.

W. Houghton.

EXPLANATION OF PLATE III.

A.

Fig. 1. An aphis killed by *Entomophthora ferruginea*, the natural size.

Figs. 2–7. Mycelial cells found in the interior of the body of the aphis. Magnified about 350 times.

Figs. 8–12. Mycelial cells, bearing on their summits the conidia in various stages of formation by abstriction.

Fig. 13. Conidia in different conditions. *a, a, a, a*, showing the truncate base by which they were attached to the conidiophores; *b, b*, conidia with the base rounded off; *c, c*, others throwing out germ-tubes from both ends.

B.

Fig. 1. An aphis previously attacked and killed by the *Entomophthora* now invaded by a *Penicillium.* Natural size.

Fig. 2. The leg of an aphis out of which the *Penicillium* is growing, mostly at the joints. Magnified 70 times.

Fig. 3. *Penicillium cladosporioides*, Fresen., removed from the insect and placed under a higher power, showing the form of growth. Magnified 350 times.

Figs. 4′, 4″. Conidia of various sizes, some of those on the right showing minute side-growths.

II.—*Description of a Moth of the Genus* Milionia *from Borneo.* By A. G. Butler, F.L.S. &c.

Early in the present year the Museum purchased a small series of Lepidoptera from Borneo, amongst which was a *Milionia*, allied to *M. zonea*, and which I fully believed, at the time when I selected it, to be the Burmese *M. pyrozonis.* On comparison with the two species from Darjiling and Tenasserim I find it to be intermediate in character, and to be the male of an insect which we have long had unnamed in the collection, on account of the indefinite character of the locality received with it—" E. India." I propose to call this species *M. Sharpei*, in honour of our ornithologist Mr. R. B. Sharpe, through whose efforts the collection was submitted to us.

Milionia Sharpei, sp. n.

Size and coloration of *M. zonea*, of Darjiling, the wings being velvety blue-black with metallic cobalt-blue streaks upon the veins at the base; the primaries with an oblique bright orange belt and the secondaries with the outer third of the same colour, with five large oval black spots immediately before the fringe. Body dull purplish black, the head, collar, and tegulæ spotted and streaked with metallic blue-green; the abdominal segments edged with metallic blue; anal tuft grey; legs with their upper surfaces brilliant metallic blue. Expanse of wings 65 millim.

♂, Borneo; ♀, " E. India." Coll. B. M.

From *M. zonea* this species may readily be distinguished by the belt of the primaries, which is quite a third narrower towards its inferior extremity and more arched throughout, and from both *M. zonea* and *M. pyrozonis* by the narrower external orange area to the secondaries, upon which the spots are oval rather than fusiform, and by the dark grey instead of stramineous or dull white colour of the anal tuft. In *M. pyrozonis* also the colouring of the orange belts is considerably redder; but this naturally alters with age.